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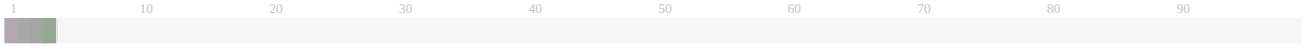

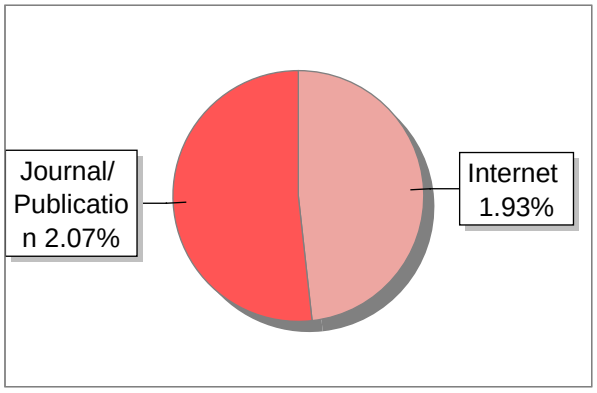

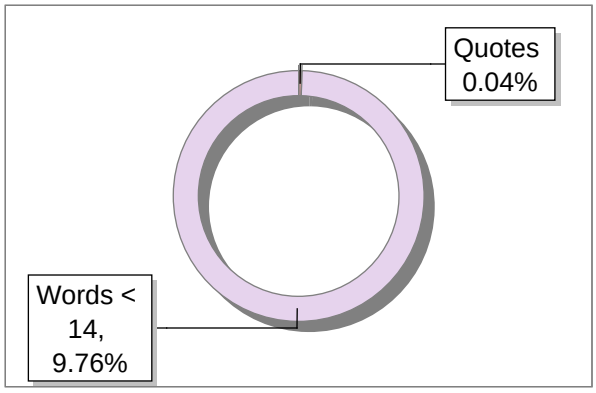

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Comparative Study of Mobilization with Movement and Home Exercises on mobility, Function and Quality of life in Frozen Shoulder among Diabetic and Non-Diabetic Individuals

A SYNOPSIS

Submitted for the Registration for the Degree

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(Physiotherapy)

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by

R Hashvardhan

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Under the Supervision of

Professor (Dr) Jasmine Anandabai

Faculty of Physiotherapy and Allied Health Science
Swami Vivekanand Subharti University
(NAAC Accredited grade "A" University)
Subhartipuram, NH-58, MEERUT-25005
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1. Introduction

Frozen shoulder is a medical condition characterized by pain and reduced range of motion, in gleno humeral joint[1]. It significantly impacts daily activities, with patients reporting reduced function and decreased quality of life [2]. Furthermore, the prevalence of frozen shoulder is notably higher in diabetic patients than in the non-diabetic population, underscoring the necessity to investigate interventions tailored to these groups [3].

Existing interventions encompass various therapeutic approaches, with a prominent emphasis on physical therapies. One such therapy, Mobilization with Movement (MWM), has demonstrated promising results in alleviating pain and improving function in various musculoskeletal conditions [4]. Home exercise programs are recommended more frequently as they have proven effective in improving mobility and maintaining functional gains. [5]. However, while MWM and home exercises have been investigated separately, limited studies have explored their combined efficacy, especially within the diabetic and non-diabetic subgroups.

The present research aims to bridge this gap by studying the combined effects of MWM and home exercises on mobility, function, and quality of life in diabetic and non-diabetic frozen shoulder patients. This study will shed light on potential nuances in therapeutic response among these cohorts by providing a comparative insight guiding clinicians toward evidence-based, patient-centric interventions.

This study delves deep into the practical implications of combining MWM and home exercises for both diabetic and non-diabetic patients. It aims to ascertain whether such a combination proves superior in addressing the triad of mobility, function, and quality of life issues inherent to frozen shoulder in these distinct patient groups. The subsequent sections outline the methods used, the results obtained, and the implications of these findings for the clinical community.

Aim of the Study: This study aims to assess the combined effects of MWM and home exercises on mobility, function, and quality of life among frozen shoulder patients, while also compare therapeutic responses to this intervention between diabetic and non-diabetic individuals.

Need of the Study: A noticeable gap exists within the landscape of therapeutic interventions for frozen shoulder in terms of the distinct response of diabetic versus non-diabetic individuals to therapy, particularly when MWMand home exercises are combined. Few studies investigate the synergistic effects of MWM and home exercises tailored to these diverse groups despite the rising prevalence of frozen shoulders, especially among diabetics. Providing truly patient-centric solutions to improve and advance existing treatment plans requires a nuanced understanding by healthcare practitioners. Thecombined intervention must be examined closely, drawing comparisons and contrasts between diabetics and non-diabetic patients. This research study will enhance the evidence base for musculoskeletal therapies and provide a broader therapeutic perspective. This will pave the way for more comprehensive, holistic, and effective care for those suffering from frozen shoulders.

2. LITERATURE SURVEY

The literature review is an instrument to obtain a clear idea and support the findings regarding the problem under study. An essential aspect of the research project is the review of related literature. A survey of the existing literature is a crucial aspect of the planning of a study, and the time spent on such a survey is wise. The study of the relevant literature is an essential step to get a full picture of what has been done and said regarding the problem under study. Such a review brings about deep inside and clear perspective of the overall field.

Commonest impairment in frozen shoulder is loss of active and passive gleno humeral range of movement. The causative factors are unknown (Yang, et al., 2007) [6].It causes pain, stiffness, and limited function of the glenohumeral joint, which can negatively impact the entire upper extremity. Patients usually experience shoulder pain, followed by loss of active and passive gleno humeral movement restricted in the capsular pattern. This condition is commonly seen in women and accounts for approximately 70% of all cases. However, men with frozen shoulders have a greater risk of prolonged recovery and significant disability (Kirkley, et al., 2005) [7]. The disease process particularly affects the antero-superior joint capsule and the coracohumeral ligament. Arthroscopy shows a small joint with loss of the axillary fold and tight anterior capsule, mild or moderate synovitis, and no adhesions. Evidence shows the presence of synovial inflammation, which leads to reactive capsular fibrosis. In response, fibroblasts and myofibroblasts deposit a thick matrix of type I and type III collagen in the joint capsule, causing the tissue to contract(Dias, et al., 2005)[8]. Acute/freezing/painful phase- the gradual onset of shoulder pain at rest with sharp pain at extremes of motion and pain at night with sleep interruption, which may last anywhere from 3-9 months.Adhesive/frozen/stiffening phase- Pain starts to subside, with progressive loss of glenohumeral motion in the capsular pattern. Pain is apparent only at extremes of movement. This phase may occur at around four months and last about 12 months. During the resolution/thawing phase, there is a gradual improvement in the functional range of motion, which can last between 1 to 3.5 years (Wirth et al., 2011). During the resolution/thawing phase, there is a gradual improvement in the functional range of motion, which can last between 1 to 3.5 years (Wirth et al., 2011) [9].

Two types of frozen shoulder, idiopathic and secondary adhesive capsulitis, have been identified in medical literature. The precise reasons for this are not yet completely understood. Idiopathic or primary frozen shoulders emerge spontaneously, without any incident. Primary frozen shoulder is believed to originate from an abnormal and extended inflammatory response and fibroblastic growth, both of which are reactions of the immune system. In contrast, secondary frozen shoulder is mainly caused by shoulder injury or surgery and can also be associated with other health issues such as diabetes mellitus, rotator cuff tendinopathy, thyroid dysfunction and hyper lipidemia. These conditions can extend the recovery period and limit the possible outcomes(Kirkley, et al., 2005). Frozen shoulder can occur due to other diseases like diabetes and hypothyroidism.It progresses in three phases: hyperalgesia, freezing, and refreezing. However, it can take anywhere from two to seven years to resolve. This condition has a chronic course and can be challenging to treat, which can have a significant impact on the patient's quality of life, compromising their ability to

perform daily activities that involve shoulder function (Fernandes, 2015) [10]. Frozen shoulder is a common condition among patients with Type I and Type II diabetes. Non-insulin-dependent diabetics are also at an increased risk of developing frozen shoulder, although not as high as insulin users (Gupta, et al., 2008). [11].The research conducted by Laslett et al. (2007), the prevalence of shoulder pain and disability, quality of life, and associated factors were investigated in patients with DM and a control group without DM over a period of 12 months through a cross-sectional examination. The study revealed that shoulder complaints are usually chronic, with 41-50% of patients experiencing shoulder symptoms even after 1-3 years. The rate of current shoulder symptoms, as measured by the Shoulder Pain and Disability Index (SPADI), was found to be 35% in individuals with DM and 17% in without DM. Additionally, 7% of the participants suffered from adhesive capsulitis, while 35.6% had rotator cuff pathology.Common shoulder symptoms are prevalent in patients, affecting one out of every three diabetic patients and one in six control patients. These symptoms are associated with reduced physical and mental quality of life, along with shoulder pain and disability, and are more severe in patients with DM, even among those with moderate shoulder pain and disability.The authors sought to examine the effects of age on shoulder pain, mobility, and quality of life (QL) without considering the factors of age or sex [12].

In a recent study, it was found that heart disease and diabetes were more commonly observed in the group of patients diagnosed with frozen shoulder, as compared to the control group. The study included a total of 32 patients and aimed to analyse the prevalence of these conditions in individuals with adhesive capsulitis. (McNeely, et al., 2005)[13].In a sex-matched case-control study in a physical therapy clinic in the USA to investigate the prevalence of frozen shoulder. The study found that a frozen shoulder was present in 75% of cases compared to 68% in controls. Although the participants' average age was not provided.The study diagnosed diabetes through self-reported questionnaires, and frozen shoulders were diagnosed clinically. Although the study presented some initial insights, it was limited by its high risk of bias (BoyleWalker, et al.,1997)[14]. A group of researchers in the USA utilized Electronic Health Records (EHRs) to conduct a sex-matched case-control study. The research demonstrated that both the case and control groups were made up of 58% females, and the mean age for cases was 56.4 years.The researchers identified diabetes and frozen shoulder using ICD-9 codes, which reflects a shift towards a more data-driven approach in medical research[15].

Satpute et al. (2021) conducted a meta-analysis to evaluate the efficacy of MWM for the management of shoulder musculoskeletal disorders. Their study suggested that MWM had a significant effect on pain, range of motion (ROM), and disability.

To accomplish this goal, researchers conducted an extensive search of six databases and Scopus to gather relevant control trials.They used the ROB 2.0 tool to assess the risk of bias and the GRADE approach to determine the evidence quality, showing the robustness of their methodology. They conducted meta-analyses that specifically targeted the subcategories of frozen shoulder and shoulder pain with mobility deficits. Through this process, they assessed

the efficacy of manual therapy in isolation and when combined with therapeutic exercise and therapeutic modalities, as compared to other conventional treatments.

The research demonstrated positive outcomes in 21 out of the 25 studies conducted. With regards to frozen shoulder, adding MWM led to significant improvements in pain, flexion and abduction movement, and overall disability. Similar results were observed for shoulder pain with mobility deficits, with MWM showing notable improvements in pain, range of motion for flexion and abduction, and disability. These findings offer compelling evidence for the efficacy of MWM in improving pain relief, mobility, and function for patients with various shoulder disorders.

The authors of the study urge readers to exercise caution when interpreting the positive results. Although the Meta-Working Memory approach appeared effective, the studies included in the analysis showed significant variations and potential biases. These inconsistencies imply that the data must be scrutinized, and more high-quality research is needed to validate these conclusions.

In summary, Satpute et al.'s (2021) systematic review and meta-analysis present MWM as a potentially effective intervention for shoulder conditions, contributing meaningfully to pain relief, increased mobility, and improved function. Nonetheless, the high risk of bias and heterogeneity within the studies calls for cautious interpretation and underlines the importance of continued research in this area [16].

A study was recently conducted by a team of researchers (Yasar et al., 2022) to examine the usefulness of neuromuscular exercises (NME) in treating idiopathic frozen shoulder (FS), a condition marked by shoulder pain and limited mobility. The primary objective of this RCT was to compare the impact of NME and traditional strengthening exercises on rehabilitating Frozen shoulder.

Forty individuals with idiopathic FS participated in the study, and they were randomly assigned to one of two groups: an experimental group that received NME alongside regular physical therapy, and a control group that underwent strengthening exercises with regular physical therapy. Both groups received their respective interventions once daily, five days a week, for eight weeks. The researchers assessed the participants' pain levels using the Visual Analogue Scale (VAS) and their Active Range of Motion (AROM) of the shoulder before and after the treatment period. The primary measure for analysis was the interaction between the group and time.

The results of the study indicated that non-surgical management (NME) was more efficient than conventional strengthening exercises in alleviating pain and heightening active range of motion (AROM) in shoulder flexion, internal rotation, and external rotation for patients with idiopathic frozen shoulder (FS). The experimental group exhibited considerably greater advancements in Visual Analogue Scale (VAS) and AROM compared to the control group. Although both groups experienced general improvements in pain levels and AROM after the eight-week intervention, the disparity between the groups was notable.

This study has significant implications for the field of physical therapy, particularly in the management of FS. The findings suggest that NME should be considered as a more effective treatment modality for FS and integrated into therapeutic practices for this condition. The work of Yasar and colleagues thus contributes significantly to the advancement of physical therapy, enhancing patient outcomes in the management of FS [17].

The study conducted by Goyal et al.(2022) research that explores the complex relationship between pain and quality of life in adults aged 45 and above. The study emerged from the recognition that pain is a prevalent issue in this age group, and its potential impact on life quality needed further investigation. The results of the study reveal a significant concern: more than one-third of adults in this demographic in India are suffering from pain. The consequences of this pain go beyond physical discomfort and significantly impair the overall quality of life. The study's conclusion is a call to action for a renewed focus on the effectiveness of pain management strategies. It highlights the importance of addressing pain as a physical symptom and a critical factor influencing the broader spectrum of life quality in older adults. The implications of Goyal et al.'s research are far-reaching, illuminating the crucial link between pain management and enhancing life quality in the aging population [18].

Several studies have made significant contributions to physiotherapy and rehabilitation for shoulder conditions. Anjum et al. (2020) conducted a randomized controlled trial, which revealed that combining physiotherapy with intra-articular steroid injections significantly improved shoulder flexion, abduction, external rotation, and SPADI scores in patients with idiopathic frozen shoulder, compared to physiotherapy alone. This study highlights the potential benefits of integrating steroid injections into physiotherapy regimens [19].

Bhavana and Soni (2017) focused their research on the effects of stretching the coracohumeral ligament in frozen shoulder patients. Their results indicated that this specific stretching technique could substantially improve the passive range of motion, underlining the importance of targeted interventions in physical therapy [20].

Gupta et al. (2019) explored the impact of clinic-based and home-based occupational therapy for patients with adhesive capsulitis who also had diabetes. Their study found no significant differences between the two approaches, suggesting that both settings are equally effective for this patient group [21].

Jellad et al. (2020) investigated the effectiveness of intra-articular distension followed by physiotherapy compared to its reverse sequence in treating primitive adhesive capsulitis of the shoulder. Their results showed that the former approach was more beneficial in improving upper extremity function [22].

Lee et al. (2016) examined the effects of stretching combined with shoulder/core strengthening exercises inpatients with frozen shoulders. Their results indicated significant improvements in range of motion, strength, task performance, and motor indices, suggesting that a comprehensive exercise regimen that includes stretching and strengthening effectively treats frozen shoulder [23].

Shishir et al. (2013) evaluated the Shoulder Accelerated Rehabilitation Protocol and its impact on shoulder function, pain, and range of motion. They reported substantial improvements over time, indicating that a structured, accelerated rehabilitation protocol can be highly effective for frozen shoulder recovery [24].

In MWM, Chidambaram et al. (2020) conducted a RCT comparing the effects of MWM alone with MWM combined with stretching exercises in treating stage 1 and 2 adhesive capsulitis. They found that the combination approach led to significantly better ROM and pain reduction improvements than MWM alone. Çelik and Mutlu (2016) studied the efficacy of stretching exercises versus a combination of stretching and joint mobilization. Their findings showed that the group receiving both stretching and mobilization significantly increased abduction, external rotation, and Constant scores at a one-year follow-up, highlighting the benefit of a combined approach [25].

Kushwah and Namrata (2018) compared the effects of capsular stretching alone to capsular stretching combined with Active Release Techniques (ART) in individuals with painful, stiff shoulders. Their results indicated significant improvements in both pain and range of motion groups, with a more notable effect in the combined therapy group [26].

Several other studies have explored various aspects of MWM. Chandrasekaran et al. (2021) compared MWM with positional release techniques, contributing to understanding these two treatment modalities. Rana et al. (2021) examined the effects of MWM combined with conventional exercises versus Maitland mobilization with conventional exercises, evaluating their differential impact on musculoskeletal rehabilitation [27,28].

Fernandes et al. (2020) Subhash and Makhija (2020) and Menek et al. (2018) studied the outcomes of MWM plus conventional physiotherapy against conventional physiotherapy alone, showing promising results in improved functionality and pain reduction. Ragav and Singh (2019) and Rayudu and Alagingi (2018) compared MWM with Kaltenborn mobilization and control groups, which are crucial in determining the superiority of one technique over the other [29,30,31,32,33].

Srivastava et al. (2018).Yeole et al. (2017) and Neelapala et al. (2016) focused on integrating MWM with other therapeutic approaches, like impairment-based exercises and cryotherapy, providing insights into how MWM can be part of broader rehabilitation programs [34,35,36].

Guimarães et al. (2016) and Delgado Gil et al. (2015) explored the immediate impact of MWM against sham treatments, while Romero et al. (2015) and Satpute et al. (2015) assessed the added value of MWM in conventional therapy settings. Reddy and Metgud (2015) and Youssef et al. (2015) examined MWM combined with conventional physiotherapy, suggesting the benefits of integrating MWM into standard treatment protocols [37-42].

Haider et al. (2014).Arshad et al. (2015).Doner et al. (2013), and Patrício et al. (2013) looked at the integration of MWM with other modalities, adding depth to the understanding of MWM's role in multimodal treatment approaches [43-46].

Teys et al. (2013, 2008), Djordjevic et al. (2012), Shrivastava et al. (2011), Kachingwe et al. (2008), and Yang et al. (2007) provided valuable insights into the effectiveness of MWM, its specific applications, and how it performs against other range-of-motion interventions [47-53].

3. **Research Question/Problem**: How does the conjoined implementation of MWM and home exercises have a differential impact on mobility, functionality, and quality of life in frozen shoulder patients, especially when comparing outcomes between diabetic and non-diabetic individuals?

4.Research Objectives:

- ✓ To find out the effects of Mobilization with Movement (MWM) and home exercises on mobility, functionality and quality of life among non-diabetic frozen shoulder individuals.
- ✓ To find out the effects of MWMand home exercises on mobility, functionality and quality of life among Diabetic frozen shoulder individuals.
- ✓ To compare the effects of MWM and home exercises on mobility, functionality and quality of life between diabetic and non –Diabetic frozen Shoulder individuals.

3. Hypothesis

Null Hypothesis (H_0):

1. There is no significant difference in the effects of MWM and home exercises on mobility, functionality, and quality of life between diabetic and non-diabetic frozen shoulder patients.

Experimental (Alternative) Hypothesis (H_1):

1. There is a significant difference in the effects of MWM and home exercises on mobility, functionality, and quality of life between diabetic and non-diabetic frozen shoulder patients.
2. The combination of MWM and home exercises yields differential effects on functionality and quality of life based on diabetic status.

4. **Methodology**

Study Design: A pre-test post-test experimental group design

Place of Study/Setting: The study will be conducted at the physiotherapy outpatient department of [XYZ Hospital/Healthcare Centre].

Sources of Data Collection: Primary data will be collated through structured interviews and physical evaluations. Standardized tools, such as the Shoulder Pain and Disability Index (SPADI) and the SF36 scale, will be utilized to gauge pain, function, and quality of life [54, 55]. Mobility measurements will be performed using a Universal goniometer to assess the range of motion in the shoulder joint.

Sampling Methods: Stratified random sampling will be utilized to ensure a balanced representation of diabetic and non-diabetic frozen shoulder patients. After stratification, participants in each stratum (diabetic and non-diabetic) will be randomly allocated to receive the intervention: a combination of MWM and home exercises. Thus, there will be two main groups: a diabetic group and a non-diabetic group, both receiving the same intervention

Sample Size: A total sample of 120 participants will be encompassed, allocating 60 individuals to each category (diabetic and non-diabetic) [12-13]. This size has been ascertained as appropriate for achieving desired statistical formula. The equation of sample size calculation are given below

$$n = \left(\frac{r+1}{r}\right)\frac{(\bar{p})(1-\bar{p})(Z_{\beta} + Z_{\alpha/2})^2}{(p_1 - p_2)^2}$$

r=ratio of controls to cases = 1

$Z_{\beta} = Z_{0.20}$ =0.842 from (Z table) 80% power.

$Z_{\alpha/2} = Z_{0.05/2} = Z_{0.025}$ = 1.96 (Z table) at type I error of 5%

$\bar{p}$= Average proportion exposed = (proportion of exposed cases + proportion of exposed control)/2

= (30 + 10) /2 = 20%

$p_1 - p_2$ = Expected effect Size = 20%

Group1 = 60

Group2 = 60

Total sample size = 120

Selection Criteria:

Inclusion Criteria:

1. Patients clinically diagnosed with adhesive capsulitis (frozen shoulder).
2. Age range of participants: 50 to 60 years.
3. Both male and female gender

4. Pain in the shoulder for at least 3 months
5. Gleno humeral range of motion both active and passive restricted in capsular pattern
6. Patient who are cooperative
7. Patients willing to actively participate and provide their informed consent.

Exclusion Criteria:

1. Individuals who have previously undergone shoulder surgeries.
2. Those with other comorbid conditions potentially affecting shoulder mobility and function.
3. H/O Shoulder manipulation under general anaesthesia
4. Neurologic deficits affecting shoulder functioning during daily activities
5. Pain or disorders of the cervical spine, elbow, wrist, or hand
6. Other pathological conditions involving the shoulder (rotator cuff tear, tendinitis, etc.)
7. Post stroke, hemiplegic shoulder.
8. Bilateral adhesive capsulitis shoulder
9. Recent cases of fracture and dislocation in the ipsilateral upper limb
10. Patients previously subjected to MWM or particular home exercises connected to the current intervention within the last six months.

Procedure: Before the intervention, the baseline characteristics of the two groups, including age, weight, height, and BMI (body mass index), will be evaluated. Similarly, outcome variables, including the passive gleno humeral range of movement measurement, SPADI, and SF36, will also be evaluated by the researcher at the baseline (day 0), at the end of the treatment (after four weeks) as well as after four weeks of follow up (after eight weeks). Test re-tests and intervention of the two groups will be conducted in the exact location and under the same environments. MWM will be administered thrice weekly for four weeks, and all patients will receive a handout detailing a home exercise program. Before the intervention, all subjects received thorough instruction on the intervention and measurement variables and their results.

Testing Procedure:

Glenohumeral Range of motion:

The procedure for assessing the glenohumeral range of motion will be conducted using a universal goniometer, strictly adhering to the methodologies proposed by Norkin, C.C., & White, D.J. (2009) [14]. The initial evaluations began on Day 0, serving as the baseline. This

study will involve a post-treatment measurement after four weeks and an eight-week assessment to evaluate any long-term changes. A pivotal element in the procedure was the use of the universal goniometer. Established studies have vouched for the reliability and validity of the universal goniometer, particularly when it comes to capturing precise measurements of the glenohumeral range of motion (Smith et al., 20xx). The device's ability to provide consistent and accurate readings ensures that the results derived from this study are both credible and dependable.

SPADI: A SPADI is used to measure the pain and disability associated with shoulder pathology. The SPADI is a self-administered index of 13 items divided into two subscales: pain and disability. It is a reliable and valid tool for measuring shoulder-related disability [15].

At the beginning of the study (Day 0), before the initiation interventions, all participants underwent a comprehensive evaluation using the Shoulder Pain and Disability Index (SPADI). This self-report questionnaire was employed to gauge the magnitude of pain and functional limitations associated with shoulder-related ailments. After the four-week treatment regimen is complete, the researcher will administer a subsequent SPADI assessment to capture any changes in pain and functional limitations, enabling them to gauge the immediate effects of the intervention.

Lastly, to ascertain the persistence or variance of the therapeutic effects and the potential for any long-term changes, a final SPADI evaluation was conducted after the four-week follow-up period (8 weeks from the start).

SF-36: The SF-36 Health Survey will be used to assess the quality of life related to shoulder function and associated pain. The evaluations will be carried out three times during the study: firstly on Day 0 before any therapeutic interventions, then after a 4-week treatment, and finally after an additional 4-week follow-up period (totalling 8 weeks from study inception). This survey has a solid foundation of empirical evidence, with documented reliability and validity, which makes it a reliable measure for our shoulder-focused inquiry [16].

Interventional Procedure

Movement with mobilization (MWM):

The application of Mulligan Mobilization with Movement (MWM) for the shoulder joint is a well-established and effective technique employed in various clinical settings. This intervention will be administered three times a week for four weeks.

The process begins with the patient seated comfortably, with the therapist ensuring that the shoulder region is clear and accessible. The therapist then applies the MWM (Mobilization with Movement) technique for Shoulder Distraction. This technique involves the therapist gently pulling the patient's arm below the elbow in an axial direction while the patient

simultaneously lifts their arm in the scapular plane. The therapist ensures that the patient's comfort will maintained throughout the procedure.

Following this, the MWM for Shoulder Internal and external Rotation will executed. In this seated position, with the patient's elbow flexed at 90 degrees and the arm resting by the side, the therapist exerts a postero-anterior directed force on the humeral head. Simultaneously, the patient actively rotates the shoulder internally and externally.

The following technique is the MWM for Shoulder Flexion. As the patient actively flexes the shoulder, the therapist applies a caudal glide to the humeral head throughout this range of movement.

Subsequently, the MWM with Traction for Abduction is employed. While supporting the patient's arm, the therapist introduces mild longitudinal traction. With the traction in place, the patient actively abducts the arm.

Finally, the therapist applies MWM (Mobilization with Movement) for Shoulder Internal Rotation. The patient will instructed to place their hand on the opposite shoulder while the therapist stabilizes the elbow. The therapist then provides a glide in the direction of the patient's forehead while the patient actively engages in internal Rotation of the shoulder. This technique helps to improve the range of motion and reduce pain in the shoulder joint. [17].

Home Exercises:

All patients will introduce to a systematic home exercise regimen tailored to maximize joint mobility, reduce pain, and restore overall shoulder function. Each participant will furnish an illustrative handout detailing the exercises and instructions to facilitate adherence and clarity. This regimen encompassed various exercises, such as the Pendulum Exercise, where the patient, standing beside a table, allows the affected arm to swing freely in gradually enlarging circles. The Wall Walk involved the patient "walking" their fingers vertically up a wall to the point of discomfort. In the Towel Stretch, a towel held by both hands aids in stretching the shoulder when pulled upwards by the unaffected hand. The Cross-Body Stretch and the Outward and Inward Rotations, employing a rubber exercise band, further supplemented the program by focusing on shoulder rotation and flexibility.